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Blister pack and solid dosage form therefor

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BLISTER PACK AND SOLID DOSAGE FORM THEREFOR

Field of the Invention

The present invention relates to a blister pack for pharmaceutical use comprising blisters containing a solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, and to said solid dosage form.

Background

Desmopressin, also known as dDAVP, is a nonapeptide and the therapeutically active ingredient (as its acetate salt) in the pharmaceutical product Minirin®, which is marketed *inter alia* as a nasal spray and a tablet formulation. Desmopressin is primarily used in the treatment of primary nocturnal enuresis, i.e. bedwetting, in children, but it is approved also for the treatment of nocturia and diabetes insipidus. The first market introduction of the tablet formulation was in Sweden in 1987. The composition of the marketed tablet form of desmopressin has remained the same to the present date.

The tablet form of desmopressin was first disclosed as set forth in the patent US 5,047,398. The subsequently issued marketing authorisations relate to a tablet where *i.a.* the mannitol, talc and cellulose components exemplified in US 5,047,398 are replaced with potato starch. In addition to desmopressin acetate and potato starch, the present tablet components are lactose, polyvinylpyrrolidone (PVP) and magnesium stearate that together form a homogeneous tablet compressed from a granulate. As a mixture of water and ethanol is used as granulation liquid in the granulate preparation, the resulting tablet also contains minor residues of those two solvents, typically 5-6% of water and 0.1% of ethanol (percentage by weight). Complete removal of residual solvents is neither required nor practical, as conditions for complete drying of solid dosage forms tend to be

either too costly in industrial scale or potentially thermally damaging to the desmopressin.

A Minirin® tablet has previously been marketed contained in a blister pack comprising polyvinyl chloride (PVC) blisters coated with PVDC (polyvinylidene chloride). An aluminium foil lid provided with a heat seal lacquer was utilised. The blister pack product was withdrawn from the market in 2002 due to a consistent problem with degradation of the desmopressin acetate during long term storage.

The advantages of blister packs compared to a spray or tablets in a bottle are well known. They involve mainly the treating physician's flexibility in selecting a particular number of dosage units and the appearance of the blisters as a practical reminder to the patient of whether a dosage unit has been taken or not. More general guidance on blister packs available for pharmaceutical use is provided in "*Pharmaceutics - The science of dosage form design*"; Ed. M.E. Aulton, Churchill Livingstone, Edinburgh, London, Melbourne and New York, 1988.

There exists a need to provide a blister pack comprising desmopressin that does not suffer from a storage stability problem.

The patent US 5,763,405 discloses a solid dosage form of desmopressin. It has an enteric coating adapted for providing desmopressin release in the small intestine, and the drug is admixed with a carrier comprising a buffering agent that buffers at a pH from about 2 to about 6. US 5,763,405 discloses the objective of increasing the desmopressin bioavailability by controlling the gastrointestinal release and ensuing enzymatic degradation of desmopressin.

Disclosure of the Invention

The present invention relates to a blister pack for pharmaceutical use comprising blisters containing a solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, in association with a pharmaceutically acceptable adjuvant, diluent and/or carrier, wherein said solid dosage form is adapted to prevent moisture related degradation of said desmopressin.

The present solid dosage form may optionally comprise at least one further additive typically selected from a disintegrating agent, binder, lubricant, flavoring agent, preservative, colorant and any suitable mixture thereof. Examples of additives that may be considered in practising the present invention are found in "Handbook of Pharmaceutical Excipients"; Ed. A.H. Kibbe, 3rd Ed., American Pharmaceutical Association, USA and Pharmaceutical Press UK, 2000.

Without being bound by a particular theory, the inventors hypothesise that the presence of residual moisture in solid dosage forms of desmopressin in combination with the increased potential influx of moisture in blister packs (compared e.g. to sealed bottles) caused the aforementioned accelerated degradation of desmopressin upon storage. The presence of moisture in solid dosage forms appears to promote dimer formation, i.e. deactivation, of desmopressin, albeit also other variants of deactivated desmopressin are formed during storage.

More specifically it has been found that a purposive selection and control of the pH level in a solid dosage form of desmopressin is particularly efficient in counteracting degradation upon storage in blister packs.

A preferred embodiment of the present invention relates to said blister pack, wherein said solid dosage form contains an agent that provides a pH in the range of from 3.0 to 6.2 as measured when said solid dosage form

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is contacted with water. In another embodiment said pH is in the range of from 3.0 to 6.0. As used herein the expression "contacted with water" refers to preparing a slurry of 1 g of a solid dosage form in 2 ml H₂O at 25°C, where the slurry is subjected to a conventional pH measurement. A pH meter of type pH3359-9 provided by Radiometer Analytical S.A. (France) was utilised for the measurements. A slurry of 1 g of the previously known Minirin® tablet in 2 ml H₂O provides a pH of about 6.6 at 25°C.

It is preferred that said pH is in the range of from 3.5 to 5.5. It is even more preferred that said pH is in the range of from 4.0 to 5.0, preferably from 4.5 to 4.8.

Said agent providing said pH is preferably an acid, preferably an acid selected from a group consisting of citric acid, hydrochloric acid and malic acid. Other examples of suitable acids are stearic acid, acetic acid, phosphoric acid, adipic acid, tartaric acid, glutamic acid and aspartic acid. The possibility of using one substance only as the pH controlling agent makes the present invention particularly convenient to practise.

In the present blister pack said blisters, and also lid foil as suitable, are preferably composed of a material selected from PVC, PVC/PVDC blends, PE (polyethylene), PP (polypropylene), polystyrene, polyester (e.g. a polyester terephthalate), paper, polyamide, PET (polyethylene terephthalate), COC (cyclic olefin copolymer) and aluminium foil or any blend thereof. As used herein the expression "blend" also encompasses a layered composite. PVC is the preferred material.

A typical aluminium blister is made of a blend which is usually a layered composite of oriented polyamide (OPA), aluminium and polypropylene, or PVC, as the bottom web, whereas the lid foil consists of aluminium. The lid foil is typically provided with a heat sealing lacquer for sealing e.g. with the polypropylene. The typical COC blister is made of PP/COC/PP as bottom web, where the

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(Fette Exakta 1). A typical prepared tablet containing 0.1 mg of dDAVP is white, convex and oval (6.8 x 9.6 mm) with a thickness of 3-4 mm and a target weight of 192 mg. It has a smooth surface without scratches or chipped edges, and shows no tendencies to lamination (so-called capping). The residual water content is 6.1% by weight. The pH of a slurry in water of the prepared tablet is 4.6 at 25°. The pH of the dried granulate, i.e. the tablet precursor material which may also be used as a solid dosage form per se, is 4.3.

Example 2: Preparation of acid free ("Standard pH"; DK7333) solid dosage form of dDAVP

Tablets are prepared as in example 1, albeit the malic acid is omitted. The pH of a slurry in water of the prepared tablet is 6.6 at 25°. The residual water content is 6.1% by weight, i.e. intentionally identical with that of the tablet in example 1.

Example 3: Incorporation of the tablets of examples 1 and 2 in PVC blisters and stability study A

20 Blister packs are prepared using conventional packaging technology provided by Inpac AB, Lund, SE. PVC blisters (RN23-A, batch #26145-1; provided by Riblex Film A/S) and an aluminium lid foil (K7606002, batch #771297; provided by said Alcan Packaging Group) were utilised
25 together with a heat lacquer (Termolack LA723) for sealing.

The blister packages containing the tablets of examples 1 and 2 were stored at 40°C at a relative humidity (RH) of 75% in climate chambers. The content of water/moisture (% by weight) and intact dDAVP (start content 100% at 0 months) were monitored over time, and the results are summarised in Table 1.

The analytical methods used were conventional Karl Fischer and LC/UV for the water and desmopressin, respectively.

In summary, the above results show that a lower pH provides an increased storage stability for a solid dosage form of desmopressin in blister packs.

- 5 All references listed are to be regarded as an integral part of the present writ.

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CLAIMS

1. Blister pack for pharmaceutical use comprising blisters containing a solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, in association with a pharmaceutically acceptable adjuvant, diluent or carrier, wherein said solid dosage form is adapted to prevent moisture related degradation of said desmopressin.

10 2. Blister pack according to claim 1, wherein said solid dosage form contains an agent that provides a pH in the range of from 3.0 to 6.2 as measured when said solid dosage form is contacted with water.

3. Blister pack according to claim 2, wherein said
15 pH is in the range of from 3.5 to 5.5.

4. Blister pack according to claim 3, wherein said pH is in the range of from 4.0 to 5.0, preferably from 4.5 to 4.8.

5. Blister pack according to any one of claims 1-4,
20 wherein said agent is an acid, preferably an acid se-
lected from a group consisting of citric acid, hydrochlo-
ric acid and malic acid.

6. Blister pack according to any one of claims 1-5, wherein said blisters are composed of a material selected from PVC, PVC/PVDC blends, PE, PP, polystyrene, polyester, paper, polyamide, PET, COC, aluminium foil and blends thereof.

7. Blister pack according to any one of claims 1-6, wherein said solid dosage form does not comprise an enteric coating.

8. Blister pack according to any one of claims 1-7, wherein said solid dosage form is selected from a group consisting of tablets, granulate powder, lozenge, cachet, dry powder, capsule and wafer sheet.

35 9. Solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, in association with a pharmaceutically acceptable adjuvant, diluent or carrier,

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ABSTRACT

The present invention relates to a blister pack for pharmaceutical use comprising blisters containing a solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, and to said solid dosage form. In one embodiment it specifically relates to a blister—pack for pharmaceutical use comprising blisters containing a solid dosage form of desmopressin, or a pharmaceutically acceptable salt thereof, in association with a pharmaceutically acceptable adjuvant, diluent and/or carrier, wherein said solid dosage form is adapted to prevent moisture related degradation of said desmopressin.

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